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BENEFIT COST GUIDELINES FOR LAND USE ALLOCATIONS IN MANITOBA

Part 1
Forestry and Agriculture, with Application to the Washow Fisher Peninsula Land Use Study Area

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PREFACE

This Report documents an evaluation framework based on benefit-cost analysis to assist in the land use allocation process of the Manitoba government. Focus is on forestry and agricultural land uses as these are most amenable to analysis at this time. Future editions are intended to improve the framework and to extend it to additional land uses such as wildlife, outdoor recreation and other unpriced values.

The study was conducted at the request of the Crown Lands Classification Committee. It was initiated due to continuing problems faced by the CLCC to systematically and objectively evaluate alternative land uses on specific parcels of land.

The three main study objectives were to prepare an evaluation framework based on established economic principles, to prepare a procedure so that field staff could conduct most of the essential studies independently, and to apply the framework to a specific case study. The case study was the Washow-Fisher Peninsula in the Interlake Region where both forestry and agricultural interests are actively competing for unallocated Crown lands. A comprehensive land use study has recently been completed. The Province is presently in the process of making actual allocations in this area.

The evaluation framework utilizes three major aspects - economic efficiency, commercial feasibility and fiscal effects upon the Provincial Treasury. This framework is consistent with the common format submitted in 1983 by the Interdepartmental Committee on Social Cost-Benefit Analysis. Economic efficiency is estimated by calculating the value-added associated with a proposal. Commercial feasibility considers all returns and costs to investors. The fiscal effect identifies all positive and negative cash flows to the treasury.

Benefit-cost ratios, net present values and rates of return can be readily calculated following the preparation of cash flow tables. The most appropriate criterion is dependent upon which factor of production is considered to be more limiting - capital or land. If capital is constraining, it is shown in the case of the Washow-Fisher Peninsula that certain lands should be allocated to forestry

and other lands to agriculture. In some cases, no clear priority of use was indicated. However, if land is considered to be the constraining factor of production, then all lands should be allocated to agriculture as these show consistently higher net returns per hectare than forestry. These conclusions, however, were not final due to the paucity of site-specific information regarding development and infrastructure costs. Other recommendations to improve the evaluation framework and the case study are contained in the final chapter.

The Report serves both a technical and an informational function. As such, some individuals may find the Report difficult to read in places. This was unavoidable given the two separate audiences to which it is directed.

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Chapter 1 Introduction

1.1 OBJECTIVE AND PURPOSE

A characteristic of land is that demands and values are often placed on it from more than one competitive end use. Proponents of a land use provide arguments which state that allocation of a land parcel to its particular use and interest will provide the highest returns to society. It is subsequently a major problem in government to decide on the best allocation of land resources. Such decisions are usually irreversible, once made governments must accept all consequences into the long-term future.

Line departments in the Province of Manitoba do not always use consistent and comparable procedures and decision criteria for evaluating Crown-owned lands of common interest. It was, therefore, the basic objective of this study to develop a procedure, employing economic criteria, principles, and values, that will be useful in the land use allocation process of government. Its adoption will aid in ensuring that the "highest and best" land uses are indeed selected.

This exercise will assist each department to analyze lands potentially under their jurisdiction in an economically acceptable and comparative manner. Focus was initially on agriculture and forestry as these are major competitive land uses and are also the most amenable to economic analysis at this time. Analysis procedures may be extended in the future to include wildlife, recreation and fisheries.

The operational objectives of the study were threefold, a) to develop an evaluation framework which is acceptable to Manitoba's Departments of Agriculture and Natural Resources for identifying the relative desirability of allocating specific parcels of land to either forestry or agricultural land use; b) to develop a format such that field personnel within each department can prepare most of the economic analysis independently; and c) to apply the evaluation framework to the Washow-Fisher Peninsula Land Use Study Area in Manitoba's Interlake region as a case study. This Report describes the results of the study.

It should be understood at the outset that in order to pursue the operational objectives of the study, it was necessary to adopt a number of rules in spite of theoretical and empirical shortcomings. It is the committee's intention that such issues be addressed in continuing studies and described in future editions of this Report. However, to ensure the timely application of a useful evaluation procedure, certain rules were temporarily adopted. These are indicated in the text of the Report as appropriate.

1.2 BACKGROUND

The Provincial Land Use Committee (PLUC) had instructed the Crown Land Classification Committee (CLCC) to complete a land use study for the Washow-Fisher Peninsula. This land use study would lead into the preparation and adoption of a Provincial Crown Land Use Classification Plan and associated operational Crown land plan for the area.

An assessment of the initial draft of the land use report[1] indicated the need to ensure that the economic analyses prepared by the Departments of Agriculture and Natural Resources were compatible. In response the CLCC requested that the two departments establish a working committee to prepare a mutually acceptable economic approach to this specific situation and which could be used to evaluate other potential conflicts. The results of that exercise are contained in this Report.

Chapter 2 A Decision Framework

2.1 BENEFIT-COST ANALYSIS

A decision-making framework is required to resolve land allocation conflicts when there are at least two parties competing for the same parcel of land and when these parties can not be fully accommodated within a multiple use plan. In such circumstances a number of factors need to be considered to determine a final allocation. The relative economic efficiency of alternative allocations is a key factor.

The preferred method for measuring the relative economic efficiency associated with alternative land use allocations is benefit-cost analysis. This procedure involves the estimation of benefits and costs for each alternative. Calculations of benefits and costs are then compared. That alternative with the best relationship between benefits and costs on the basis of economic criteria is considered to be the most efficient use of the land.

Technically, this procedure involves a number of steps. First, one must identify the benefits and costs which ought to be included in the analysis. Second, one must set up a cash flow statement in which benefits and costs are allocated to specific years. Third, benefits and costs occurring in different years are brought to present values using discounting techniques. Fourth, the relationships between benefits and costs are estimated using standard methods of calculation.

The principal aspect of each of these steps is discussed in the remainder of this section. However, it should be noted that this Report is not intended to be a benefit-cost analysis manual, as much as a manual to guide the application of benefit-cost analysis in relevant government departments. Therefore, a comprehensive reference on this subject should be referred to, see Mishan[2] or the Treasury Board Guidelines[3].

2.2 BENEFITS AND COSTS

2.2.1 Monetary Value

Only readily quantifiable monetary values relating to agriculture and

forestry were considered in the benefit-cost analysis described in this document. Methods to quantify unpriced values and to incorporate them into benefit-cost analysis are relatively complex and not well established. Unpriced (nonmonetary) values and costs are usually identified[4] and discussed in the land use study preceding the benefit-cost analysis. Issues pertaining to unpriced values will be addressed by the technical committee in consultation with appropriate specialists in future editions of this Report.

2.2.2 Single Purpose Land Use

With respect to agriculture and forestry the benefit-cost analysis in this current Report was based upon the single use of an area. Where possible, the differing qualities of land to support that use was reflected. This analysis led to the identification of land categories which could support the single uses of agriculture, forestry or wild (nonuse by agriculture or forestry), and the efficiency of that use relative to alternatives.

Actual subareas for single-use agriculture or forestry would have to be of sufficient size to warrant independent development, or be contiguous to existing developments so as to minimize infrastructure and other costs.

Where the benefit-cost analysis and other relevant information, such as contained in the land use studies, indicated no clear decision as to the superior land use more detailed benefit-cost evaluations, incorporating unpriced values as relevant, will be necessary.

It is most important to note that we were not dealing with site specific proposals in this exercise. The necessary detailed benefit and cost information was simply not available. As such, the technical committee had to rely upon average values for benefits and average values for costs. Additionally, many of the proposals would only be implemented decades into the future from current time. Therefore, more distant future developments could only be evaluated using broad averages and generalized expectations.

2.2.3 Evaluation Aspects

The economic efficiency of a proposal can be determined from the broadest perspective of resource allocation in all society, usually considered to be at

the national level. From a narrower perspective economic efficiency can be measured in terms relevant to the provincial economy. This more narrow perspective was adopted in this analysis.

Distributional aspects of a proposal are also relevant in the decision process. In this study, these were selected according to commercial feasibility and fiscal effect, the impact upon the provincial treasury.

All three aspects are required to fully evaluate and compare each land use alternative. An evaluation of economic feasibility was necessary to measure the proposal's overall resource allocation efficiency at the broad level of the Manitoba economy; the proposal's commercial feasibility was required to measure its lasting power in the business community; and finally the fiscal effect was required to determine the impact upon the budget of the Manitoba government.

These efficiency and distributional aspects of benefit-cost analysis are described in more detail as follows:

A) ECONOMIC EFFICIENCY

Net economic value was measured by estimating the value of a product over and above the costs of its various inputs. This becomes an estimate for producer surplus provided that the opportunity costs associated with labour and land are zero.[5] Since both the agricultural and forest industries are defined to the point where the majority of their output is exported out of the province, the value of the consumer surplus (the other portion of net economic value) can be ignored. Economic efficiency is considered to be maximized in this approach when that product is chosen which has the greatest relative increase in value in comparison to purchased inputs.

A gain in economic efficiency is reflected by an increase in the net provincial product, the perspective chosen for this study.

For purposes of the analysis described in this Report the change in "census value-added" was used as a proxy for the change in net provincial

product. This was necessitated by differing data bases between forestry and agriculture. Census value-added was obtained for forestry outputs from various reports published by Statistics Canada. For agriculture, comparable value-added estimates were derived directly from crop yield, product price and various cost data as provided by agricultural specialists.

Benefits in census value-added are subsequently defined as the gross revenues flowing to the enterprise. Costs are those expenditures on the physical outputs of other industries.[6]

B) COMMERCIAL FEASIBILITY

In terms of commercial feasibility, benefits and costs were defined in the more traditional manner of returns and costs to investors, both private and public, given the current economic and marketing structure.[7] As with economic efficiency, benefits are the gross revenues flowing to the enterprise. Costs, however, now represent all monetary outlays to support production. As such, costs now include wages, salaries and costs previously identified.

C) FISCAL EFFECT

Benefits and costs from the fiscal effect aspect were defined strictly from the viewpoint of the treasury of the Province of Manitoba. Benefits were the provincial tax revenues attributable to the proposal (including reductions in provincial government payments) while costs were all expenditures made by provincial government agencies as a direct result of the proposal.

2.3 CASH FLOW IDENTIFICATION AND ESTIMATION OF PRESENT VALUES

Having identified the benefits and costs of each proposal, the next step was to set up a cash flow statement. In such a statement money values are listed in the year in which they are expected to occur. A simple illustrative sequence of cash flows is shown in Table 1.

Table 1 Example of Cash Flow Table

Year	Revenues	Costs	Annual Cash Flow
0	$	$(100)	$(100)
1		(80)	(80)
2	35	(10)	+25
3	35	(10)	+25
4	35	(10)	+25
5	35	(10)	+25
6	35	(10)	+25
7	35	(30)	+5
8	35	(10)	+25
9	35	(10)	+25
10	35	(10)	+25
TOTALS	$315	$(290)	$+25

In this procedure, it is standard economic accounting practice to indicate expenditures in brackets as a negative cash flow (money going out) and revenues as a positive cash flow (money coming in).

In this example, the large initial capital investment beginning in Year 0 is completed in Year 1. The next five years are characterized by smaller operating expenditures. Year 7 requires a larger cost item for renewing a major component, after which expenditures return to the previous operating levels.

Revenues are constant throughout, beginning in Year 2.

The annual net cash flow is shown in the right-hand column. It is calculated by simple row arithmetic.

At first glance, it would appear that the excess of revenues over expenditures as shown in the column totals indicates a project which is economically justifiable. However, this does not take into account the cost of capital over time and the fact that revenues do not begin immediately.

The standard procedure to facilitate comparison of cost and revenue streams is to calculate present values. Present value (PV) is that amount of money in the current time period which if allowed to earn compound interest would be equivalent in value to money earned or needed at a specific time in the future. The interest rate (discount rate) should be based upon the "social opportunity cost of capital" and the "social rate of time preference".

Present values can be readily calculated with the use of interest rate tables. The use of electronic spread sheets having built-in financial formulas greatly speeds and simplifies detailed calculations.

In this simple numerical example, the present values are subsequently calculated to be as follows, using a 5 per cent interest rate:

PV of revenues = $236.93

PV of costs = $(258.10)

PV of annual cash flows = $(21.17)

These now show that costs are greater than revenues. The investment proposal should be rejected on the basis of economic infeasibility.

This simple example also illustrates two other common problems in the estimation of costs and benefits. These relate to the treatment of inflation and to the choice of the appropriate planning period.

Inflation was accommodated in this study by estimating all future costs and benefits in terms of constant dollars. This means that price levels were assumed to remain constant over time. These were expressed in terms of the year in which it was easiest to obtain cost and revenue values. This is usually the year in which the study is actually conducted, in this case, 1984.

Assuming a constant price level implies that the interest (discount) rate should also be free of inflationary effects. A "real" rate should be chosen in comparison to a "nominal" rate.

Present values are also affected by the length in years of the money streams. As the number of years into the future increase, the present value of the more distant future cost or return becomes relatively less due to the effects of compounding. The lower the discount rate, the more critical the choice of time period for discounting becomes.

2.4 RELATING BENEFITS TO COSTS AND THE DECISION CRITERION[8]

2.4.1 NPV, B/C Ratio and IRR

Three methods commonly used to relate benefits to costs in measuring the comparative economic efficiency and distributional aspects associated with alternative land use allocations.

A. NPV - net present value (i.e. the present value of benefits less the present value of costs).
B. B/C Ratio - the benefit/cost ratio (i.e. the ratio of the present value of benefits to the present value of costs).
C. IRR - the internal rate of return (i.e. the estimated rate of growth of capital invested and reinvested in the project).

The basic economic criterion for feasibility is that the present value of benefits exceed the present value of costs over the planning period. The potential feasibility of a proposal is indicated its net present value (NPV) is positive or if its benefit/cost ratio (B/C ratio) is greater than unity.

In the simple numerical example of the previous section the NFV is equal to $(21.17) and the B/C ratio is 0.92. The project is not economically feasible.

The internal rate of return (IRR) estimates the rate of growth of capital invested (and profits reinvested) in the project. In the numerical example of the previous section the IRR is estimated to be 2.45 per cent. The IRR, as with NPV and B/C ratio, is frequently used as a decision criterion (rank projects according to IRR, highest best), however, it has several technical drawbacks that restrict its use. Its most important limitation is that its exclusive use can lead to selection of an inferior proposal. Mathematical factors can also result in the calculation of several

rates of return, leading to ambiguous answers. A third problem is that the IRR formula implicity assumes that all cash flows are either reinvested or discounted at the computed yield rate. This assumption is reasonable only if the IRR is within a realistic borrowing and lending range.

The modified internal rate of return procedure (MIRR) overcomes these problems by utilizing stipulated reinvestment and borrowing rates. The MIRR was subsequently also chosen for use, with the stipulated rate equivalent to the discount rate (no distinction as to borrowing or lending).

This is not to say that the IRR is useless; it is a very valuable indicator of the rate of growth of capital invested in a project, based entirely upon "internal" factors. When "external" interest rates are incorporated to derive the MIRR the resultant value has a less intuitive meaning. Additionally, the MIRR is essentially identical to the present value criterion for project selection as the external discount rate is now explicitly incorporated.

2.4.2 The Decision Criterion

In some cases project rankings will be the same whether NPV estimates or B/C ratios are used. In other cases project rankings will change depending upon which measure is used. The choice of whether to use NPV estimates or B/C ratios as the appropriate measure of relative economic efficiency when they do differ will depend in part upon judgments of the analysts and the decision makers.

At issue is the relative availability of the factors of production required for development. If capital is considered to be the scarce factor, then the B/C ratio is more appropriate as it expresses benefits per unit of investment funds. If land is considered to be the scarce factor then NPV per hectare is the most appropriate.

The three broad factors of production most commonly identified in economics theory are land, labour and capital. However, any appropriate classification of "the things required for making a commodity"[9] can be utilized. Thus there are a wide variety of inputs which could be considered as candidates for scarcity.

In economics, a commodity is considered to be scarce when "...the quantity demanded would exceed the quantity supplied if its price were zero".[10] According to this definition most factor inputs could be classified as scarce. Therefore, it is necessary for judgments to be made regarding which input is the scarcest. This may be very difficult. Further work on this issue is required.

Chapter 3 Guidelines to Implementation

Economic feasibility studies, as described in the previous section, are essential to determine if the proposed land developments would be viable in terms of allocative and distributional effects: economic efficiency at the provincial level, commercial feasibility at the project level, and effects upon the provincial treasury. However, there are two sets of difficulties which complicate the direct application of a benefit-cost analysis. First, there are a number of general economic considerations which must be resolved to implement the procedure. Second, there are a number of differences in the data bases for the forestry and the agricultural sectors which must be overcome to enable comparability. These issues are addressed in the following sections.

3.1 GENERAL ECONOMIC CONSIDERATIONS

As previously stated, the efficiency and distribution criteria adopted for the comparison of land use alternatives require the development of cash flow projections for each alternative. Future levels and values of production depend upon the interactions between supply and demand in each output and input market. An econometric model is useful to aid in capturing such dynamic interactions. However, construction of such a model exceeded the terms of reference for this study. Instead a series of procedural guidelines were adopted upon which to base cash flow projections. These guidelines have the basic assumption that the most practical method of analyzing the future is to utilize production and price data from current situations and the more recent past.

Two penalties are incurred in return for this convenience and simplicity. First, current trends in production are often imbedded into projections leaving little or no room for the continually changing developments which characterize an economy. Second, there is little consideration for the equilibrating effects of price changes given the central function of relative price changes in allocating resources within an economy.

General guidelines relating to prices, discount rates, infrastructure and provincial cash inflows are presented next. These are followed by more specific guidelines relating directly to forestry and agriculture.

3.1.1 Prices

Prices were selected that even out year-to-year variations due to influencing factors relating to short-term climatic, political and economic variables. The committee's recommended procedure was to use the average of published values for the last five years. This five-year average reflected the underlying assumption that prices will remain stable into the future in relation to each other.

All prices were converted to current year dollars to eliminate the distorting effects of inflation. The "Gross National Expenditure: Implicit Price Index - Total" is recommended as the most appropriate index.[11]

Such "normalized" prices were assumed to be reasonable estimates of future prices. However, they can be inappropriate and misleading if underlying market, structural and technological conditions are changing significantly. Judgment was necessary in certain instances to provide price estimates which were perceived to better represent future values.

3.1.2 The Discount Rate

Alternative land use allocations were evaluated using a base real discount rate of 5 per cent. This rate is consistent with the recommendations by the Interdepartmental Committee on Social Cost-Benefit Analysis as a compromise to reflect Manitoba's social rate of time preference.[12] The Interdepartmental Committee also recommended that sensitivity analysis, where warranted, should be performed using rates of 3, 7 and 10 per cent. The 3 per cent rate reflects an historic long-term time preference for public projects; the 7 and 10 per cent rates reflect alternative estimates of the social opportunity cost of capital. The 10 per cent rate was recommended by the Committee for use in projects which are commercial in nature.

3.1.3 Public Infrastructure

For agriculture, the major infrastructure components on these lands would relate to the provision of roads, electricity and telephone. Other services such as regional drainage systems might be required on specific lands with problems of excess moisture.

Forestry would require mostly resource-access roads.

The estimation of infrastructure costs would likely require assistance from various government departments. Preparation of a general plan of the project areas would be an essential component in a site-specific analysis. Actual costs would vary greatly from place to place for various technical reasons. As with other costs and revenues, it is essential to estimate in which year the infrastructure costs would be expected to occur.

3.1.4 Provincial Cash Flow

As shown in Table 2, the Province of Manitoba generates about two-thirds of its revenues from income-related taxes. Specifically, these include the personal and corporation income taxes which are directly related to income, and the general sales tax, the motive fuel tax and alcohol taxes which are less directly related to income levels. The balance of the government's revenues from own sources are generated from royalties, etc. Income related taxes have averaged about 7.6 per cent of Manitoba's gross provincial product.

On this basis, provincial government cash inflows were reasonably estimated by adding 7.6 per cent of the proposal's value-added (i.e. income-related taxes) plus any identifiable nonincome-related provincial taxes, i.e. royalties, that are directly attributable to the proposal.

Table 2 Government of Manitoba Revenue Sources

	1978	1979	1980	1981	1982
Income Related Tax Revenues	739.4	788.8	852.4	941.2	1,113.8
Other Tax Revenues	329.8	382.4	457.2	504.5	587.1
Total from Own Sources	1,069.2	1,171.2	1,309.6	1,445.7	1,700.9
Gross Provincial Product	9,268	10,423	11,376	13,099	13,913
Income Related Taxes as % of Gross Provincial Product	8.0%	7.6%	7.5%	7.2%	8.0%

*Source: Statistics Canada 68-207 and Manitoba Bureau of Statistics.

3.1.5 Secondary Impacts and Regional Effects

The present study did not incorporate any secondary effects of changes in agricultural and forestry production. Such an analysis, including the use of multipliers, is not within the scope of conventional benefit-cost analysis.

At the provincial level, any increased agricultural production in the Interlake area would likely not lead to a significant increase in processing as there is already considerable excess capacity, or limited opportunity, in the grain and livestock processing industries. The net increase in primary agricultural production was subsequertly assumed to be sold in export markets. Focus in this study was, therefore, upon the income creation aspects of primary production that is directly dependent upon the land base. It is recognized, however, that production shifts might occur from one area in the Interlake to another to seize upon local cost and market advantages.

With regard to forestry the situation is more complex due to the fact that the vast majority of forestry production is processed in Manitoba. Harvesting rights are appurtenant to processing facilities. Value-added estimates for use in the benefit-cost analysis were subsequently restricted to the sawmill and pulp and paper mill industries as these are directly dependent upon the land base. Other wood using industries such as millwork, and cabinet, paper bag and box manufacturing, were hence not considered.

The benefit-cost analysis utilized in this study gauged the relative and absolute desirability of increased production by assessing effects upon net provincial product. As such, all inter-business transactions are cancelled out. Such flows become important when the perspective is narrowed to regional effects or the consideration of specific industries due to problems such as high unemployment in identified occuptional or social groups.

The identification of linkage effects can be achieved with the use of input-output tables. However, a thorough analysis is dependent upon a great amount of detailed information for each industry. This data should be as region specific and up-to-date as possible.

Economic multipliers based upon a provincial input-output model using 1979 data are now available from the Manitoba Bureau of Statistics.[13] For agriculture, an increase of one dollar of direct gross domestic production (value-added) is estimated to have a provincial multiplier effect of 1.620. This is the total of the direct, indirect and induced effects of the increased production value. For forestry the corresponding multiplier effect is estimated at 2.006.

If multiplier effects are to be incorporated, the analysis should also be expanded to include a thorough treatment of the labour component in any development, especially if unemployed or underemployed workers would be involved.

3.2 FORESTRY GUIDELINES

3.2.1 Supply

Manitoba regulates the supply of timber off its forested lands in accordance with sustained yield management principles. The total supply of timber available within designated management areas (known as Forest Management Units or FMU's) depends largely upon the total land base devoted to the growth of productive forests. Withdrawals from the land base will cause a reduced annual supply of timber from the FMU since there is less land available to support the harvest over the forest's growth cycle. Calculation of this land-base effect is the responsibility of the Forest Inventory Section within the Forestry Branch of the Manitoba Department of Natural Resources.

The exact amount by which the annual supply of timber would be affected by changes to the productive forested land base depends upon the productivity of the specific site. Unfortunately, site productivity data were incomplete, Canada Land Inventory records being the only source of site productivity data at the present time. The relationship between this data base and the data compiled by the Forest Inventory Section is unclear at this time. The Forest Inventory Section currently calculates the land-base effect on the assumption that all productive forested lands have the same site productivity within existing cover types for a FMU.

The long-term sustainable yield is derived, in part, on the basis of the forest's expected average growth rate. The mean annual increment (MAI) is a measure of the forest's present average growth rate given the level of past and present forest management programs. In the long term, actual timber supply should approximate the managed gross annual increment for the management area.

In the short run there are a number of difficulties which must be overcome before the annual increment can be harvested. Many of these

difficulties center upon the inherited age/class distribution of the existing forest. Therefore, for the practical purposes of implementing sustained yield management, the Forestry Branch calculates a timber supply estimate for short-term purposes which is consistent with the long-term timber supply. This short-term timber supply estimate is called the annual allowable cut (AAC). The ACC is calculated under a number of different utilization assumptions. Differences between utilization assumptions reflect different outlooks for technological and economic constraints affecting the area's industry. Four versions of AAC are presently calculated. Net Operable I calculations contain the most conservative assumptions; Net Operable II and Net Operable III calculations assume a more technological upgraded industry. Theoretical cut calculations, the fourth version, reflects 100 per cent physical potential of the merchantable portion of the tree.

3.2.2 Demand

Increased demand for a commodity results in two effects - firstly, increased prices and secondly, increased physical supply (if possible) given the new and higher prices. Without an econometric model it is not possible to estimate to what extent future increased demand pressure for wood products would be discouraged by higher prices or met through greater production. Adoption of the procedural guideline approach reduces the demand side discussion to simply identifying the year in which the resources are fully utilized within individual FMU's. On this basis, the following guidelines were adopted:

A. In any FMU in which the actual harvest has reached or exceeded 80 per cent of the annual allowable cut (for softwoods or hardwoods), any change to the land base will be assigned to have an immediate impact upon the industry.

B. In all other areas, hardwoods are assumed to remain in surplus throughout any proposed study period.

C. In any FMU within the Commercial Forested Area (but excluding those meeting the 80 per cent rule above), land-base effects on the softwood areas will be assumed to have an effect in the twentieth year of the proposal.

D. In any FMU outside the Commercial Forested Area, the land-base effect will be assumed to have an impact in the fortieth year of the proposal.

E. Immature stands are assumed to enter into the AAC thirty years after the mature stands within the FMU are included, or by the fortieth year, whichever comes first.

Adoption of these guidelines implied the use of a number of more basic assumptions. For example, it was assumed that intensified forest management is not cost-competitive with continued geographic expansion of the industry. This assumption can be readily tested by including an intensified forest management regime as an alternative. The use of the 80 per cent rule in Guideline A implies that the established industry within these areas is reluctant to move. Therefore, decreased timber supply results in lower production or greater imports of resources from outside the province. As a result greater value is placed on forested lands than would otherwise be the case. This assumption can also be readily tested by identifying substitute sources of Manitoba timber within an alternative.

Guideline B results in no value being placed on hardwood timber outside of areas in which the 80 per cent rule holds. This guideline implies that the future demand for hardwoods will remain very low (despite recent developments) and that hardwood lands can not be viably converted to softwood production. As a result less value is placed on these lands than would otherwise be the case. Should this situation change, appropriate revisions can be made to future editions of this Report.

Guideline C was derived in part from the Twenty Year Forest Management Plan adopted by the Manitoba Department of Natural Resources. The Twenty Year Plan expects the demand for Manitoba timber to exhaust the timber supply within the Commercial Forested Area by the 2000 A.D. Guideline C maintains this full utilization time always twenty years in the future. It is therefore more conservative.

Guidelines D and E were included for completeness. It is expected that few projects will be evaluated which have economic effects accruing beyond fifty years from present.

3.2.3 Prices

The central role of the pricing system in any allocation issue has been ignored in this exercise. To simplify the analysis, future prices were estimated on the basis of the average inflation-adjusted price for the latest five-year period. The latest calculated values for some of the more important forestry items are listed in Table 3.[14]

Table 3 Forestry Unit Values

	5-YEAR BASE	LOGGING	MANUFACTURING
		(1981 $/cu. m.)	
ITEM:			
Value of Shipments[1]	1978/9 - 1982/3	$28.56	$92.81
Value Added[1]	1978/9 - 1982/3	12.30	38.37
Input Costs[2]	1978/9 - 1982/3	16.26	54.44
Fixed Costs[3]	1977 - 1981	1.97	3.83
Provincial Treasury[4] Receipts	1978/9 - 1982/3	0.43	2.92

[1] Source Statistics Canada and Department of Natural Resources.

[2] Excludes returns to factors of production. Derived by subtracting Value-added from Value of Shipments.

[3] Source Statistics Canada.

[4] Derived from Table 1, i.e. 7.6 per cent of value-added.

3.3 AGRICULTURAL GUIDELINES

3.3.1 Supply

Estimates of agricultural output from specific parcels of land were derived on the basis of the soils capability classification in combination with actual agriculture use and productivity patterns in comparable areas.

The soil capability classification system for agriculture provided a good data base for developing productivity estimates. In this classification soils are grouped into seven classes on the basis of their limitations for agricultural use. The first three classes are considered capable of sustaining production of common field crops. The fourth class is physically marginal for sustained arable agriculture. The fifth class is capable of use only for permanent pasture and hay. The sixth class is capable of use only for wild pasture. The seventh class is for soils and land types considered unsuitable for arable agriculture or permanent pasture. While soil areas in classes one to four are capable of use for cultivated field crops, they are also capable of use for permanent pasture or hay.

The soil capability classification for agriculture is a suitability and not a productivity classification, although one often reflects the other. The classification reflects the kinds and the degree of limitation associated with the management of the land for agricultural purposes.

As such, soil capability data were supplemented with additional information. First, the expected agricultural use pattern and, second the expected yields per unit of land were estimated. Both estimates were based upon the expert opinion of agricultural specialists. Current experience on similar soils to those under analysis was be utilized. Farm technology and production reflected good average crop management.

3.3.2 Demand

The Manitoba agricultural industry was assumed to have little, if any, impact upon satiating world market demands. All production would be sold at prevailing prices, using five-year averages for evaluation purposes.

Additionally, due to limited opportunity for expansion in Manitoba's livestock and food processing industries in the forseeable future, it was assumed that all net agricultural production would enter the Canadian export market.

3.3.3 Prices and Costs

A) INPUT VALUES

Costs of agricultural production are comprised of two broad categories.

One category is those direct costs relating to the annual operating and fixed ccsts to the farmer for actual crop production. The other category is the cost of development such as clearing and drainage to make the land fit for cropping.

The Crop Planning Guides published annually by Maritoba Agriculture provided appropriate estimates of the direct costs to the farmer. These costs are detailed by type of agricultural output. Several adjustments were necessary, however, to render these estimates appropriate to the analysis:

i) Costs of crop insurance were excluded as insurance is a stabilization program and in the long run costs will be balanced by payouts.

ii) All interest rate calculations utilized the same rate as employed for the discount rate.

iii) Costs were be modified where necessary to reflect local conditions. Such variables as distance to input and output markets, soil type, climate and management ability were factored into production costs where deviations from provincial averages were deemed significant.

Development costs account for the expense of converting the lards from their natural state to a condition suitable for cropping. These included, where necessary, such costs as clearing, breaking, initial seedbed preparation, stone removal and drainage. Drainage would involve both the cost of on-farm drains plus the cost of the system to deliver excess water to the receiving river or lake.

B) OUTPUT VALUES

Detailed product prices are published each year in the Manitoba Agriculture Yearbook. These prices are those that would be received at the nearest shipping point in the case of grains and oilseeds and at the farmgate for tame hay. As published prices are overall averages for the province, it was necessary for judgments to be made to accept these prices or to reflect unusual factors such as crop grade that are specific to a local area under study. As stated earlier, five-year average prices were used.

Chapter 4 Washow-Fisher Peninsula - A Case Study

This chapter of the Report describes a direct application of the benefit-cost principles and procedures discussed in the previous chapters. Independent benefit-cost analyses of the study area when allocated solely to forestry and when allocated solely to agriculture are presented first. These analyses are presented in sufficient detail to ensure their illustrative value. The two analyses are brought together in the final section of this chapter in a decision-making framework.

4.1 FORESTRY BENEFIT-COST ANALYSIS

This section presents the benefit-cost analysis of the forestry potential of the Washow-Fisher Peninsula, as geographically defined in the land use study. To ensure comparability with agricultural procedures it was necessary to derive estimates for forest productivity and to adjust certain costs to reflect their sensitivity to forest productivity. These matters are discussed first, followed by cash flows and the resulting relationships between benefits and costs.

4.1.1 Economic Background

The annual allowable cut (AAC) attributable to the Washow-Fisher Peninsula by the Forestry Branch is 36 720 cubic metres on a Net Operable III basis. As the Forestry Branch does not maintain land productivity classes this AAC was prorated to Canada Land Inventory (CLI) land classes. This was done on the basis of average gross annual increment (GAI). The GAI was derived by multiplying the area by the average mean annual increment (MAI) for each land class. The AAC was then distributed to CLI land classes in proportion to the distribution of the GAI. Details of these calculations are presented in Table 4.

Logging input costs, logging wages and logging value-added are related to timber volumes per land area. Input costs for logging were estimated in Table 3 at $16.26/cu. m. Since CLI Class 7 is unsuitable for commercial logging it was excluded from this calculation. With CLI Class 7 lands excluded, the remaining AAC was 36,720/cu. m. - 7,684/cu. m. = 29,036/cu. m. Total annual logging input costs were estimated at 29,036/cu. m. x

16.26/cu. m. = $472,117. Assuming that two-thirds of this value is related to volume and that one-third is related to area the distribution of logging input costs per CLI class was derived as shown in Table 5. As expected, costs have been distributed between land class in such a manner that costs per cubic metre increase as volume per hectare decreases.

Extending this procedure tc logging value-added and to logging wages, and extending the analysis to include Class 7 lands, Table 6 shows the relationships yielded with land classification.

Table 4 Derivation of Annual Allowable Cut by CLI Land Class

CLI FOREST LAND CLASS	AREA (ha)	AVERAGE MAI (cu. m.)	GAI (cu. m.)	% OF TOTAL GAI	PRORATED AAC (cu. m.)
3	2 108	5.7	12 016	4.4	1 633.5
4	23 714	4.3	101 970	37.8	13 863.0
5	30 306	2.9	87 887	32.5	11 948.4
6	7 800	1.5	11 700	4.3	1 590.6
7	70 655	0.8	56 524	20.9	7 684.5
TOTAL	134 583		270 097	100.0	36 720.0

Table 5 Estimation of Logging Input costs by CLI Land Class

CLI CLASS	RELATED TO VOLUME		RELATED TO DENSITY		TOTAL	
	% of AAC	$	$ of Area	$	$	$/cu. m.
3	5.6	17,707	3.3	5,189	22,896	14.02
4	47.8	150,175	37.1	58,377	208,652	15.05
5	41.2	129,521	47.4	74,605	204,125	17.08
6	5.5	17,242	12.2	38,403	55,645	22.91
TOTAL	100.0	314,745	100.0	157,372	472,117	16.26

Table 6 Logging Input, Wages and Value-Added by CLI Land Class

(1981$ per cubic metre)

CLI CLASS	LOGGING INPUTS	LOGGING WAGES	LOGGING VALUE-ADDED
3	12.75	6.63	14.54
4	13.37	7.12	13.51
5	14.59	8.08	11.48
6	18.09	10.84	5.65
7	24.44	15.82	(4.91)

Finally, it was noted that the study area lies within the Commercial Forested Area, but outside of the area of immediate impact. In accordance with the previously stated guidelines, it was assumed that full harvest levels would be reached in the twentieth year of the analysis. No progressive harvest build-up was incorporated and no allowance was made for hardwood potential.

4.1.2 Cash Flows

Three sets of cash flows were prepared for each land class to represent the three evaluation aspects of a) economic efficiency, b) commercial feasibility and c) the fiscal effect on the provincial treasury. For illustrative purposes only the set of cash flows associated with Class 3 lands is described in detail in this section.

A) ECONOMIC EFFICIENCY

The impact on net provincial product was determined by relating benefits as measured by the gross value of shipments to costs. The relevant costs excluded all returns to factors of production. Benefits were assumed to begin in Year 20 and to continue uninterrupted until the end of the planning time frame, i.e. Year 50. They were determined by multiplying the inflation adjusted unit value derived in Section 3.2.3 prorated by the AAC as calculated for each land class. For Class 3 lands the total value of shipments was therefore \$28.56/cu. m. + \$92.81/cu. m. = \$121.37/cu. m. as measured in 1981 dollars. This unit value was inflated by 19.9 per cent to obtain an estimated value of shipments of \$145.52/cu. m. in terms of 1984 dollars. The total value of shipments associated with any individual land class is subsequently \$145.52/cu. m. multiplied by the total harvest attributed to that land class, eg. \$145.52/cu. m. x 1,633.5 cu. m./year = \$237,640, as shown in the cash flow table for Class 3 lands, Table 7.

Capital investment requirements, the first category of cash flows associated with costs, were estimated by calculating the present value of the average fixed cost factor over the thirty-year time horizon using a real discount rate of 5 per cent. On this basis, capital investment attributable to the 1,634 cubic metres of AAC on Class 3 lands amounted to \$177,076 which would be expended in Year 19, as shown in Table 7.

Table 7 Forestry Cash Flow Projections Class 3 Lands

	YEAR				
	0-18	19	20	21-49	50
A) ECONOMIC EFFICIENCY					
Benefits	-	-	237,640	237,640	237,640
Costs:					
- Capital	-	177,076	-	-	-
- Public Infrastructure	-	33	33	33	-
- Cash Outlays	-	-	134,043	134,043	134,043
- Forest Management	-	-	-	66	132
Total Costs	-	177,109	134,076	134,142	134,175
NET CASH FLOW	-	(177,109)	103,564	103,498	103,465
B) COMMERCIAL FEASIBILITY					
Benefits	-	-	237,640	237,640	237,640
Costs:					
- Capital	-	177,076	-	-	-
- Public Infrastructure	-	33	33	33	-
- Cash Outlays	-	-	134,043	134,043	134,043
- Wages	-	-	39,806	39,806	39,806
- Royalties	-	-	2,205	2,205	2,205
- Forest Management	-	-	-	66	132
Total Costs	-	177,109	176,087	176,153	176,186
NET CASH FLOW	-	(177,109)	61,553	61,487	61,454
C) FISCAL EFFECT					
Benefits:					
- Taxes	-	(13,460)	7,871	7,866	7,863
- Royalties	-	-	2,205	2,205	2,205
Total Benefits	-	(13,460)	10,076	10,071	10,068
Costs:					
- Forest Management	-	-	-	66	132
- Public Infrastructure	-	33	33	33	-
Total Costs	-	33	33	99	132
NET CASH FLOW	-	(13,493)	10,043	9,972	9,937

The cost of public infrastructure would be related to the area of land requiring such services on an annual basis. The annual area of land was determined by assuming that each land class used a homogeneous age distribution of timber spanning the entire rotation period. For the Washow-Fisher Peninsula the average rotation period was assumed to be approximately 80 years. The annual area harvested was calculated for each class by using the simple area control method: dividing the total area in each class by the rotation age. Costs were assumed at $25 per hectare. Total annual costs were then derived by multiplying the annual area by the cost per hectare. As these expenditures would be incurred one year before harvest (i.e. this assumes a one year construction/preparation period) they begin in Year 19 and are completed in Year 49.

All factor returns, transfer payments, wages and royalty payments were excluded in the economic efficiency calculations. Capital and public infrastructural investments were assumed to be incurred in Year 19 (i.e. one year ahead of the harvest schedule) and would be completed in Year 49. Expenditures for manufacturing inputs (again excluding all factor returns) were assumed to be incurred during the year of actual harvest and manufacture. These would begin in Year 20 and continue until Year 50. However, forest management costs would be incurred the year after an area is harvested for reforestation. As such they begin in Year 21 and continue to Year 51. Since the analysis had a fixed time frame of 50 years, forest management expenditures which would be incurred in Year 51, were charged to the proposal as an expenditure for Year 50. Forest management costs were also estimated on the basis of the area to be treated. Unit costs were assumed to be $50 per hectare.

B) COMMERCIAL FEASIBILITY

The commercial feasibility cash flows were prepared in a similar manner and are shown in Table 7 for Class 3 lands. Two additional expenditures, namely wages and royalties, were now incorporated. Wage rates were determined for each land class as discussed in Section 4.1.1 and attributed to the year in which the timber is harvested.

Royalties were determined by applying the relevant royalty in the forest management unit to the harvest. In this case the softwood rate would be $1.35 per cubic metre of softwoods on the basis of current rates. Royalty payments enter into the cash flow table in the same year as the timber is harvested.

C) FISCAL EFFECT

Fiscal benefits to the provincial treasury would consist of increased tax receipts and royalties. Tax receipts were estimated at 7.6 per cent of value-added, as described in the previous chapter, see Table 2. Potential tax receipts were therefore estimated to be 7.6 per cent of the net cash flow calculated in the economic efficiency aspect. Royalties were identical to those calculated for the commercial effect.

With respect to costs, forest management and public infrastructure expenditures would be the major items. As with royalties, these were estimated to be identical to those calculated for commercial efficiency, as shown in Table 7.

Tables 8 to 11 contain the cash flows for the remaining forestry land classes.

Table 8 Forestry Cash Flow Projections Class 4 Lands

	YEAR				
	0-18	19	20	21-49	50
A) ECONOMIC EFFICIENCY					
Benefits	-	-	2,016,772	2,016,772	2,016,772
Costs:					
- Capital	-	1,502,788	-	-	-
- Public Infrastructure	-	371	371	371	-
- Cash Outlays	-	-	1,154,696	1,154,696	1,154,696
- Forest Management	-	-	-	741	1,482
Total Costs	-	1,503,159	1,155,067	1,155,808	1,156,178
NET CASH FLOW	-	(1,503,159)	861,705	860,964	860,594
B) COMMERCIAL FEASIBILITY					
Benefits	-	-	2,016,772	2,016,772	2,016,772
Costs:					
- Capital	-	1,502,788	-	-	-
- Public Infrastructure	-	371	371	371	-
- Cash Outlays	-	-	1,154,696	1,154,696	1,154,696
- Wages	-	-	345,960	345,960	345,960
- Royalties	-	-	18,715	18,715	18,715
- Forest Management	-	-	-	741	1,482
Total Costs	-	1,503,159	1,519,742	1,520,483	1,520,853
NET CASH FLOW	-	(1,503,159)	497,030	496,289	495,918
C) FISCAL EFFECT					
Benefits:					
- Taxes	-	(114,240)	65,490	65,433	65,405
- Royalties	-	-	18,715	18,715	18,715
Total Benefits	-	(114,240)	84,205	84,148	84,120
Costs:					
- Forest Management	-	-	-	741	1,482
- Public Infrastructure	-	371	371	371	-
Total Costs	-	371	371	1,112	1,482
NET CASH FLOW	-	(114,611)	83,834	83,037	82,638

Table 9 Forestry Cash Flow Projections Class 5 Lands

	YEAR				
	0-18	19	20	21-49	50
A) ECONOMIC EFFICIENCY					
Benefits	-	-	1,738,238	1,738,238	1,738,238
Costs:					
- Capital	-	1,295,240	-	-	-
- Public Infrastructure	-	474	474	474	-
- Cash Outlays	-	-	1,024,296	1,024,296	1,024,296
- Forest Management	-	-	-	947	1,894
Total Costs	-	1,295,714	1,024,769	1,025,716	1,026,190
NET CASH FLOW	-	(1,295,714)	713,469	712,522	712,048
B) COMMERCIAL FEASIBILITY					
Benefits	-	-	1,738,238	1,738,238	1,738,238
Costs:					
- Capital	-	1,295,240	-	-	-
- Public Infrastructure	-	474	474	474	-
- Cash Outlay	-	-	1,024,296	1,024,296	1,024,296
- Wages	-	-	311,929	311,929	311,929
- Royalties	-	-	16,130	16,130	16,130
- Forest Management	-	-	-	947	1,894
Total Costs	-	1,295,714	1,352,829	1,353,776	1,354,249
NET CASH FLOW	-	(1,295,714)	385,409	384,462	383,989
C) FISCAL EFFECT					
Benefits:					
- Taxes	-	(98,474)	54,224	54,152	54,116
- Royalties	-	-	16,130	16,130	16,130
Total Benefits	-	(98,474)	70,354	70,282	70,246
Costs:					
- Forest Management	-	-	-	947	1,894
- Public Infrastructure	-	474	474	474	-
Total Costs	-	474	474	1,421	1,894
NET CASH FLOW	-	(98,948)	69,880	68,861	68,352

Table 10 Forestry Cash Flow Projections Class 6 Lands

	YEAR				
	0-18	19	20	21-49	50
A) ECONOMIC EFFICIENCY					
Benefits	-	-	231,398	231,398	231,298
Costs:					
- Capital	-	172,426	-	-	-
- Public Infrastructure	-	122	122	122	-
- Cash Outlays	-	-	147,472	147,472	147,472
- Forest Management	-	-	-	244	488
Total Costs	-	172,547	147,594	147,838	147,959
NET CASH FLOW	-	(172,547)	83,805	83,561	83,439
B) COMMERCIAL FEASIBILITY					
Benefits	-	-	231,398	231,398	231,398
Costs:					
- Capital	-	172,426	-	-	-
- Public Infrastructure	-	122	122	122	-
- Cash Outlays	-	-	147,472	147,472	147,472
- Wages	-	-	46,787	46,787	46,787
- Royalties	-	-	2,147	2,147	2,147
- Forest Management	-	-	-	244	488
Total Costs	-	172,547	196,528	196,772	196,894
NET CASH FLOW	-	(172,547)	34,870	34,627	34,505
C) FISCAL EFFECT					
Benefits:					
- Taxes	-	(13,114)	6,369	6,351	6,341
- Royalties	-	-	2,147	2,147	2,147
Total Benefits	-	(13,114)	8,516	8,498	8,489
Costs:					
- Forest Management	-	-	-	244	488
- Public Infrastructure	-	122	122	122	-
Total Costs	-	122	122	366	488
NET CASH FLOW	-	(13,235)	8,395	8,132	8,001

Table 11 Forestry Cash Flow Projections Class 7 Lands

	YEAR				
	0-18	19	20	21-49	50
A) ECONOMIC EFFICIENCY					
Benefits	-	-	1,117,931	1,117,931	1,117,931
Costs:					
- Capital	-	833,021	-	-	-
- Public Infrastructure	-	1,104	1,104	1,104	-
- Cash Outlays	-	-	809,733	809,733	809,733
- Forest Management	-	-	-	2,208	4,416
Total Costs	-	834,125	810,837	813,045	814,149
NET CASH FLOW	-	(834,125)	307,094	304,886	303,782
B) COMMERCIAL FEASIBILITY					
Benefits	-	-	1,117,931	1,117,931	1,117,931
Costs:					
- Capital	-	833,021	-	-	-
- Public Infrastructure	-	1,104	1,104	1,104	-
- Cash Outlays	-	-	809,733	809,733	809,733
- Wages	-	-	271,999	271,999	271,999
- Royalties	-	-	10,374	10,374	10,374
- Forest Management	-	-	-	2,208	4,416
Total Costs	-	834,125	1,093,210	1,095,418	1,096,522
NET CASH FLOW	-	(834,125)	24,721	22,513	21,409
C) FISCAL EFFECT					
Benefits:					
- Taxes	-	(63,394)	23,339	23,171	23,087
- Royalties	-	-	10,374	10,374	10,374
Total Benefits	-	(63,394)	33,713	33,545	33,462
Costs:					
- Forest Management	-	-	-	2,208	4,416
- Public Infrastructure	-	1,104	1,104	1,104	-
Total Costs	-	1,104	1,104	3,312	4,416
NET CASH FLOW	-	(64,498)	32,609	30,233	29,046

4.1.3 Relating Forestry Benefits and Costs

The results of the comparison of forestry benefits to forestry costs are presented in this section. The four relationships of benefit-cost ratio, net present value, internal rate of return and modified internal rate of return were calculated for each perspective and for each forest land class. Net present value per hectare was also calculated. The results of these calculations for the base discount rate of 5 per cent are shown in Table 12. A sensitivity analysis with respect to alternative discount rates is contained in background documents to these studies.

Table 12 Forestry Benefit-Cost Relationships

LAND CLASS	BENEFIT-COST RATIO	NET PRESENT VALUE Total	$/ha	IRR %	MIRR %
A) ECONOMIC EFFICIENCY					
3	1.6	$ 541,500	256.90	58	10
4	1.6	4,493,400	189.50	57	10
5	1.6	3,699,300	122.10	55	10
6	1.5	426,100	54.60	48	9
7	1.3	1,478,100	20.90	37	9
B) COMMERCIAL FEASIBILITY					
3	1.3	$ 296,600	139.80	35	9
4	1.2	2,350,000	99.10	33	9
5	1.2	1,771,400	58.50	30	8
6	1.1	138,500	17.80	20	7
7	1.0	(181,400)	(2.60)	(1)	3
C) FISCAL EFFECT					
3	94.6	$ 53,500	25.40	74	10
4	70.1	445,000	18.80	73	10
5	45.7	367,700	12.10	70	10
6	21.3	42,900	5.50	62	10
7	9.0	154,100	2.20	48	9

A) ECONOMIC EFFICIENCY

Allocation of all land classes to a forestry land use has a favourable impact upon the net provincial product. All benefit-cost ratios for economic efficiency are well in excess of unity; net present values are all positive and the IRR and MIRR estimates exceed the discount rate. It should be noted, however, that although land Class 3 has the most favourable relationships most of the net benefits to the provincial economy are attributable to land Classes 4 and 5 due to the large amount of harvest obtained from these lands.

B) COMMERCIAL FEASIBILITY

With the costs of public infrastructure and forest management charged against the project, and assuming that forest opportunities are divisible, land Classes 3 through 6 could support a viable commercial forest operation. Land Class 7, with a benefit-cost ratio below unity and a negative net present value, would clearly not be a viable commercial operation. It would only be developed if required to fulfill minimum scale requirements to support commercial development on adjacent higher quality lands or if an isolated parcel were surrounded by better forests. Class 6 is marginal. Its benefit-cost ratio of 1.1 would be near the minimum threshold for commercial feasibility.

C) FISCAL EFFECT

As shown in Table 12, there would be a favourable impact upon the provincial treasury for all land classes.

4.2 AGRICULTURAL BENEFIT/COST ANALYSIS

4.2.1 Economic Background

Potential agricultural crops, yields, proportions, and farm returns and costs were estimated for lands in the Washow-Fisher Peninsula study area in accordance with the guidelines presented in Section 3.3 of this Report. This information is summarized in Table 13, categorized according to CLI agricultural classes. For each land class, farm revenues and costs per unit hectare were calculated to provide a preliminary indication of farm viability. Capital costs for machinery and structures were converted to annual costs in the preparation of this table to represent an ongoing farm operation. Crop production costs are detailed in Appendix A.

Table 13 indicates that all lands except Class 6 would show positive net cropping returns to the farmer under the cost and return assumptions utilized in this study.

Table 13 Cropping Revenues and Costs per Hectare

($/hectare)

CROP	PROPORTION	YIELD (t/ha)	PRICE ($/tonne)	GROSS CROP RETURN	WEIGHTED RETURN	CROP COSTS	WEIGHTED COST	NET CROP RETURN
Class 2,3,03,6W(3R)								
Wheat	0.35	2	219.10	438.20	153.37	284.70	99.65	153.50
Barley	0.25	2.7	144.84	391.07	97.77	273.33	68.33	117.74
Canola	0.2	1.1	364.79	401.27	80.25	279.63	55.93	121.64
Tame Hay	0.2	6.1	72.55	442.56	88.51	177.75	35.55	264.81
TOTAL	1.00				419.90		259.45	160.45
Class 4								
Wheat	0.3	1.9	219.10	416.29	124.89	284.70	85.41	131.59
Barley	0.1	2.1	144.84	304.16	30.42	273.33	27.33	30.84
Canola	0.1	1	364.79	364.79	36.48	279.63	27.96	85.16
Tame Hay	0.5	5.5	72.55	399.03	199.51	177.75	88.87	221.28
TOTAL	1.00				391.29		229.58	161.71
Class 04								
Wheat	0.2	1.8	219.10	394.38	78.88	284.70	56.94	109.68
Barley	0.2	2	144.84	289.68	57.94	273.33	54.67	16.35
Canola	0.1	1	364.79	364.79	36.48	279.63	27.96	85.16
Tame Hay	0.5	5.4	61.67	333.00	166.50	121.51	60.76	211.49
TOTAL	1.00				339.79		200.33	139.47
Class 5,05								
Tame Hay	1.0	4.1	61.67	252.84	252.84	121.51	121.51	131.33
TOTAL	1.00				252.84		121.51	131.33
Class 6								
Native Hay	1.0	2.7	36.28	97.96	97.96	117.45	117.45	(19.51)
TOTAL	1.00				97.96		117.45	(19.51)

Table 13 does not allow for any costs of development. These would vary according to the nature of land. All lands in the study area were assumed to be wooded, hence requiring tree removal. Certain lands would require drainage before they could be cropped. All lands except for Class 6 would also require some minimal municipal servicing of roads, power and telephone. These costs and their timing in the development sequence were incorporated into the analysis in the preparation of cash flow tables.

4.2.2 Cash Flows

Annual cash flows were calculated by computer, one for each of the seven different development and cropping categories that were identified in the study area. The area of land in which each category and the pertinent characteristics and costs of development are summarized in Table 14. Land clearing costs were derived from costs experienced under the Crown Lands Improvement Project. Drainage and infrastructure costs were based on broad assumptions.

Table 14 Development Characteristics and Costs by CLI Land Class

CLI CLASS	AREA	DEVELOPMENT INITIATION	DEVELOPMENT PERIOD	DEVELOPMENT REQUIREMENT*		INFRASTRUCTURE COSTS
	(ha)	(year)	(years)	Initial Year	Second Year	($/ha)
2, 3	21 100	5	20	$325 (no drainage)	$200	$185
4	25 900	5	20	325 (no drainage)	200	185
4W, 6W(3W)	5 665	10	10	550 (drainage required)	550	185
03	21 450	10	10	550 (drainage required)	550	185
04	12 140	10	10	550 (drainage required)	550	185
5	2 025	7	15	410 (drainage required on one half of lands)	410	185
6	16 190	7	20	Nil	Nil	Nil
TOTAL	104 470					

*Bush removal, field preparation and drainage.

The actual development period was assumed to vary between the land categories. Where no drainage systems would be required to remove excess moisture it was assumed that 20 years would be required for these lands to be fully developed, with an equal amount developed in each year. Clearing was assumed to begin five years from present time. Where drainage systems would be essential to render lands suitable for cropping it was assumed that the rate of development would be more rapid once initiated, to reduce the costs of debt servicing on the capital-intensive, publicly-funded portion. Development was assumed to be initiated ten years from present to allow for the additional time required for final design and funding of specific projects.

Agricultural cropping activities were assumed to begin in the second year after clearing was initiated. No benefits or costs accruing after 50 years from present were considered. No development or infrastructure costs would occur after the development period was completed.

The seven different categories of land shown in Table 14 along with the three evaluation aspects required 21 cash flow tables. Appendix B, for illustrative purposes, is a portion of computer printout showing the cash flow table for CLI 2 and 3 lands under the commercial feasibility aspect.

4.2.3 Relating Agricultural Benefits and Costs

Table 15 presents the results of the benefit-cost analysis for each land class and evaluation aspect using a 5 per cent discount rate. The specific results are discussed in more detail in the following subsections.[15]

Table 15 Agricultural Benefit-Cost Relationships

5 Per Cent Discount Rate

LAND CLASS	BENEFIT/COST RATIO	NET PRESENT VALUE		IRR	MIRR
		Total ('000)	$/ha	%	%
A) ECONOMIC EFFICIENCY					
2,3	1.6	$26,000	$1,230	21	11
4	1.6	31,700	1,220	21	11
4W,6W(3W)	1.3	4,000	700	12	7
03	1.4	19,500	910	13	8
04	1.3	8,100	670	11	7
5	1.5	1,400	680	13	8
6	1.1	1,300	80	17	9
B) COMMERCIAL FEASIBILITY					
2,3	1.4	18,700	880	17	10
4	1.4	22,800	880	17	10
4W,6W(3W)	1.2	3,200	570	10	7
03	1.2	12,300	570	10	7
04	1.2	4,600	380	9	6
5	1.3	900	440	10	7
6	0.8	(3,200)	(200)	-	-
C) FISCAL EFFECT					
2,3	27.6	1,900	90	21	5
4	1.0	100	0	21	5
4W,6W(3)	0.6	(200)	(30)	-	4
03	0.8	(400)	(20)	-	5
04	0.6	(400)	(40)	-	4
5	0.6	(100)	(40)	-	4
6	Not defined	100	10	17	9

A) ECONOMIC EFFICIENCY

The direct comparison of agricultural value-added to forestry value-added required that all farm costs associated with the variable and fixed costs of the cropping activity be subtracted from gross farm revenues, with the exceptions of interest for operating capital and the costs of farm labour. The fixed costs for farm machinery and farm structures were subtracted in the years that they would be purchased. Local taxes were also subtracted, as these were assumed to represent purchased inputs from other industries. Costs associated with development and infrastructure were additionally subtracted from gross revenues as these costs also represented purchases of direct outputs from other industries.

B) COMMERCIAL FEASIBILITY

In addition to the costs listed under economic efficiency, the expenses of interest on operating capital and of farm labour (whether hired or the farmer's own labour) were subtracted from gross farm revenues.

C) FISCAL EFFECT

Derivation of fiscal effects to the Manitoba treasury were relatively straightforward. The sole inflows (benefits) were the income-related taxes which, as derived in Chapter 3 of this document, were calculated at 7.6 per cent of value-added. Value-added for these calculations were defined as the difference between revenues and the costs associated with economic efficiency.

The only costs to the provincial treasury were assumed to be those associated with essential infrastructure to provide road, power and telephone service to the newly developed farmlands and associated farmyards. All costs for bush clearing, field preparation and drainage system development were considered to be charged to the farmer. They would be recovered by ensuring that land sale revenues would be sufficiently high to recoup all development expenditures. No lags in cost recovery were assumed. This topic requires more detailed consideration in future studies.

A) ECONOMIC EFFICIENCY

Benefits exceeded costs for each of the land development classes. Benefit-cost ratios ranged from 1.1 to 1.6. Net present values ranged from $80 to $1,233 per hectare, with the highest values being obtained on the better quality soils. The best soils, namely Class 2, 3 and 4 soils, had internal rates of return of about 21 per cent, the corresponding estimates of modified internal rates of return were 10.5 per cent. Class 6 lands were only marginally feasible.

Total net present values of $26 million for Class 2 and 3 lands, $32 million for Class 4 lands and $19 million for the Class 03 lands are substantial sums of income that could be realized within the province. Development of a large portion of these lands should be seriously considered.

B) COMMERCIAL FEASIBILITY

When viewed from the commercial feasibility aspect, benefit-cost ratios were positive for all land classes except for Class 6. Class 2, 3 and 4 lands had benefit-cost ratios in the order of about 1.4. Net present values per hectare were about $880 per hectare. The internal rate of return was about 17 per cent while the modified internal rate of return was measured at 9.5 per cent.

C) FISCAL EFFECT

Class 2 and 3 lands would have very favourable effects upon the provincial treasury as they were indicated to have benefit-cost ratios of 27.6. Class 4 lands were only marginally favourable from the provincial perspective. All other lands would represent a net drain upon the treasury of from $20 to $40 per hectare in terms of net present value under the assumptions utilized in this analysis.

4.3 FORESTRY COMPARED TO AGRICULTURE

In the previous sections of this chapter, forestry and agriculture were independently subjected to the benefit-cost analysis procedures as outlined in the evaluation framework. This section now compares the two uses to identify which would be the superior land use on the basis of the three evaluation aspects.

4.3.1 Benefit Cost Ratios

Table 16 is a matrix showing agricultural land classes on the left side and forestry land classes along the top. Each cell in the matrix has an entry showing the superior land use for the various combinations that might be possible on a specific land parcel. These were derived by comparing the benefit-cost ratios shown in Tables 12 and 15. Use of benefit-cost ratios accommodates the problem of varying scale of project.

Table 16 Forestry and Agricultural Benefit-Cost Ratio Comparisons: Economic Efficiency Aspect

AGRICULTURAL LAND CLASSES	FORESTRY LAND CLASSES				
	3	4	5	6	7
2,3	*	*	*	A	A
4	*	*	*	A	A
4W, 6W(3W)	F	F	F	F	*
03	F	F	F	*	A
04	F	F	F	F	*
5	F	F	F	*	A
6	F	F	F	F	F

A Agricultural use indicates higher benefit-cost ratio.
F Forestry use indicates higher benefit-cost rato.
* Benefit-cost ratios are essentially identical.

If capital availability is considered to be the most constraining factor of production on the basis of benefit-cost ratios, then Table 16 indicates that there is no clear superiority of use between agricultural Classes 2, 3 and 4 versus forestry Classes 3, 4, and 5. Forestry land Classes 3, 4 and 5 are superior to all other agricultural land classes. Forestry Classes 6 and 7 show a mixed relationship with agriculture, as indicated in the table.

With respect to commercial feasibility, agricultural Classes 2, 3 and 4 have higher benefit-cost ratios than all forestry classes, as shown in Table 17. Forestry Class 3 is generally superior to the remaining agricultural classes while forestry Classes 4 and 5 are generally equivalent. Forestry Classes 6 and 7 have generally lower benefit-cost ratios.

In regards to fiscal effects, the forestry classes show superior returns to the Province for all land classes. No table was therefore prepared.

Table 17 Forestry and Agricultural Benefit-Cost Ratio Comparisons: Commercial Feasibility Aspect

AGRICULTURAL LAND CLASSES	FORESTRY LAND CLASSES				
	3	4	5	6	7
2, 3	A	A	A	A	A
4	A	A	A	A	A
4X, 6X(3)	F	*	*	A	A
03	F	*	*	A	A
04	F	*	*	A	A
5	*	A	A	A	A
6	F	F	F	F	-

A Agricultural use indicates higher benefit-cost ratio.
F Forestry use indicates higher benefit-cost ratio.
* Benefit-cost ratios are essentially identical.
- No benefit-cost ratio greater than unity.

4.3.2 Net Present Values

If land is considered to be the more scarce factor of production, then agriculture has clearly higher returns to society as all net present values estimates are much greater than forestry for the economic efficiency aspect. Net present values per hectare are approximately $1,230 for Class 2, 3 and 4 lands compared to forestry values which range from $20 to $260.

Commercial net present values show similar relationships, with agricultural returns per hectare greatly exceeding forestry returns except for Class 6 agricultural lands and Class 7 forestry lands which are not commercially viable.

Forestry would have favourable net present value effects upon the provincial treasury for all land classes while only agricultural Classes 2 and 3 would be positive.

4.3.3 Rates of Return

Forestry internal rates of return are much larger than agriculture for all land classes and all evaluation aspects. However, when modified rates of return are compared, which assumes that any returns will be reinvested at the assumed discount rate (5 per cent) rather than in other comparable land developments, the MIRR's are remarkably similar, in the ranges of 8 to 11 per cent for agriculture and 9 to 10 per cent for forestry in the economic efficiency aspect.

Agricultural lands of Classes 2, 3 and 4 in the commercial feasibility aspect have MIRR's of 10 per cent, while the remaining agricultural land categories (except Class 6) are around 6 and 7 per cent. In comparison, forestry Classes 2 to 6 range between 7 and 9 per cent. Class 7 forestry and Class 6 agriculture are not commercially viable, as stated previously.

In regards to fiscal effects, forestry MIRR's are mostly 10 per cent while agriculture's is generally around 4 to 5 per cent.

4.4 CASE STUDY CONCLUSIONS

Using economic efficiency as the main criterion, then the choice of which land use is superior is dependent upon whether or not capital or land is considered to be the more constraining factor of production. If capital is scarce, as measured by private and public budget constraints, then no clearly superior land use was identified on parcels of land having agricultural Classes 2, 3 or 4 and forestry Classes 3, 4 or 5. Forestry use of forestry Classes 3, 4 and 5 would be superior to agriculture over all other agricultural classes. A mixed relationship was obtained for the remaining categories, as show in Table 16.

If capital is considered to be unlimited in supply, with its opportunity cost equivalent to the discount rate, then the net present value criterion would be more appropriate. This would lead to the conclusion that agriculture is a clearly superior land use to forestry for all categories.

The technical committee places great caution on these preliminary results due to the many broad assumptions that had to be made in this initial iteration. Of most importance are the assumptions with regard to agricultural development and infrastructure costs as these were obtained with no technical engineering or municipal planning inputs. Actual costs need to be determined by specific investigation of potential agricultural settlement areas. As the need for land drainage increases and the distance to provide market road, power and telephone services increases, the higher costs per unit of land will lead to reduced net returns. Such isolation factors and other economies of scale in development and subsequent production are of paramount importance.

Other land uses such as recreation and wildlife have not been considered. No account was made for any benefits or costs accruing after 50 years into the future. As well, the actual landscape is often quite complex, with individual land classes being interspersed in conjunction with other classes of widely disparate quality.

Nevertheless, these results should serve a very useful function to guide future more site-specific studies or judgments that would lead to actual land use allocation decisions.

Chapter 5 Summary and Conclusions

5.1 INTRODUCTION

This Report has documented an evaluation framework based on benefit-cost analysis for identifying the relative desirability of allocating Crown lands in Manitoba to either an agricultural or forestry land use. A standardized framework using established economic principles was required to systematically and consistently evaluate allocation options while accommodating differing data bases for the resource uses under review. This Report also attempted to present a format so that field personnel within line government agencies could prepare most of the economic analyses independently. Finally, this Report presented the results of applying the evaluation framework to the Washow-Fisher Peninsula in the Manitoba Interlake area. The case study served as an illustrative application of the benefit-cost procedures while revealing the many practical matters that have to be resolved in the evaluation and decision processes of government.

This document was written in a manner so as to provide a general reference while serving, at the same time, a technical role to record the principles and the reasoning used by the committee in developing the format. In this process, a number of economic issues were glossed over. It is intended that these will be dealt with in more detail in future editions. As well, a number of broad assumptions were made, especially in regards to the case study, in light of the paucity of site-specific information as to the costs of infrastructure development and productivity.

5.2 THE EVALUATION FRAMEWORK AND APPLICATIONS TO CASE STUDY

Three aspects of benefit-cost analysis were established to evaluate land uses in Chapter 2: 1) Economic Efficiency, 2) Commercial Feasibility and 3) Fiscal Effect. An evaluation of economic feasibility was necessary to measure overall resource allocation efficiency at the broad provincial level. The proposal's commercial feasibility was required to assess lasting power in the business community. The fiscal effect was required to determine potential impacts upon the budget of the Manitoba Government.

A gain in economic efficiency is reflected by increases in net provin-

processing and secondary effects, tax revenues and various specific items directly associated with the forestry and agricultural industries.

In Chapter 4, the process and results of applying the entire evaluation framework to a specific case study in Manitoba was described. The chosen area was the Washow-Fisher Peninsula study area on the western shores of Lake Winnipeg, just north of presently developed agricultural lands. Agricultural interests wish to expand into this area, while forestry interests wish to preserve large portions for forestry use. Wildlife and recreation are other major resource uses in the area.

Chapter 4 and supporting appendices presented considerable detail regarding economic and technical matters relating to forestry and agricultural land uses. Under the specific assumptions utilized, and using economic efficiency as the main decision criterion, it was shown that benefit-cost ratios were essentially identical for either forestry or agricultural land uses on specific parcels of land of agricultural CLI Classes 2, 3 and 4 capability and forestry Classes 3, 4 and 5. Society would really be indifferent, from the economic efficiency aspect, as to which land use such parcels should be allocated. Other combinations were shown to be better utilized in either agriculture or forestry, depending upon which use had the higher benefit-cost ratio. As discussed earlier, benefit-cost ratios would serve as the ranking factor if capital was considered to be the more scarce factor of production.

If capital is not constrained by budgetary or other factors, then net present values would be the decision criterion from an economic perspective. On this basis, agricultural use would provide much higher returns per hectare than forestry. All lands in the Washow-Fisher Peninsula of agricultural interest were shown to have positive net present values under the economic efficiency aspect indicating economic viability. Class 6 lands, however, would not be commercially viable. Unfortunately, all lands except for Classes 2,3 and 4 would show net drains upon the provincial treasury according to the assumptions utilized. Some cost recovery for infrastructure expenses might be warranted to reduce or elimante public subsidy to the lower quality lands.

cial product. Net provincial product was measured by estimating "census value-added". Census value-added can be obtained for forestry outputs from various Statistics Canada reports while, for agriculture, comparable value-added estimates can be derived from crop yield, product price and various cost data. Benefits are the gross revenues flowing to the enterprise while costs are those expenditures on purchased inputs from other industries.

Commercial feasibility was measured by adding the costs of labour and other specific investor expenses that had not been considered in the precise definition of census value-added previous. Benefits would remain the same as in economic efficiency.

For the fiscal effect, benefits were defined as the increase in provincial revenues (taxes, royalties, etc) while costs were all expenditures by provincial agencies as a direct result of the proposal.

Following the identification of these benefits and costs the evaluation framework required that cash flow tables be prepared. All flows further than 50 years into the future were not considered. Discounted present values were then calculated using a real discount rate of 5 per cent, with other rates for sensitivity analysis.

Benefit-cost ratios, net present values and rates of return could now be readily calculated for each major identifiable land classification and evaluation aspect to identify which single land use would have more favourable benefit to cost relationships. The most appropriate relationship is dependent upon which factor of production is judged to be more scarce - if capital is considered to be constraining then the benefit-cost ratio is more appropriate, if land is the constraining factor, the net present value per unit of land area will be the better relationship to use for decision-making. Rates of return are not reliable estimates for project ranking but provide useful information on capital growth.

Various guidelines to implementation were presented in Chapter 3, to aid in the actual process of calculating the various economic indicators. These related to such matters as price, yields, discount rates, infrastructure,

The committee emphasizes that these results utilized broad cost and other assumptions. Actual development or infrastructure costs may deviate significantly from assumed values, depending on such factors as distance or volumes of water to be removed by drainage. Further study or judgments are needed to better identify the true expenses involved.

5.3 NEEDS AND RECOMMENDATIONS

Study limitations, the trade-offs that were made in theoretical issues, the necessity to make very broad assumptions, the need for additional study iterations where no clear decisions could be made as to which land use is superior, the need to expand the analysis to include other resource users and various other factors led to the preparation of the following list of needs and recommendations for future study. These would aid in final decision-making. The list is divided into two categories, one dealing with the evaluation framework in general and the other dealing with the specifics of the case study.

Evaluation Framework

- Further consideration of the nature of scarce factors of production, especially "capital" versus "land".
- More analysis with regards to opportunity costs associated with labour, land and capital.
- The consideration of other resource users such as wildlife and recreation, including "unpriced values" such as aesthetics and benefits and costs accruing in the far distant future.
- Various theoretical issues relating to more precise estimates of future supplies and demands of specific commodities.
- Preparation of field forms to guide line staff data gathering and analysis.

Washow-Fisher Peninsula Case Study

- Identify more site-specific agricultural development and infrastructure costs and reevaluate evaluation indicators.
- Better estimates of forest productivity.

- The need to incorporate unpriced values, as discussed earlier, including such factors as fire hazard to forestry lands from agricultural developments.
- The need to better assess the timing when developments should actually proceed, taking into account current and projected market conditions.
- The need to consider when salvage forestry operations would be warranted preceding agricultural development if the latter is chosen.
- Local landscapes can be extremely complex, with good quality and poor quality lands intermixed and/or in close proximity. Procedures need to be developed to analyze complex landscapes from a practical point of view.

The study committee feels that the exercise documented in this Report has been very useful. Not only do the participants better understand the other's discipline but, in the numerous discussions that have ensued, an actual data gathering and useful decision-making procedure has been developed. This procedure is theoretically sound, analytically practical, and enables the systematic and objective comparison of differing land uses. Improvement is still needed, and will occur in an evolving manner as further study phases are carried out.

Footnotes

1 Prepared by Interlake Bloc Planning Committee for the Crown Land Classification Committee, Washow-Fisher Peninsula Land Use Study: Background Report, Province of Manitoba, October, 1984.

2 Mishan, E. J., Cost-Benefit Analysis, 2nd Edition, George Allen and Unwin Ltd., 1975.

3 Treasury Board, Government of Canada, Benefit-Cost Analysis Guide, Supply and Services, Ottawa, March, 1976.

4 Sinden and Warrell, Unpriced Values: Decisions Without Market Prices, John Wiley & Sons, Inc., 1984.

5 Currie, J. M., Murphy, J. A., and Schmitz, A., The Concept of Economic Surplus and Its Use in Economic Analysis, The Economic Journal, December, 1971.

6 This approach represents maximum estimates of each project's potential impact on the provincial economy. Establishing more realistic opportunity costs for factors of production is a high priority for further study.

7 It should be noted that public investments which are essential for the successful physical operations of the endeavour are included as costs in the commercial feasibility analysis. This represents a departure from the traditional approach where only the benefits and costs of the private investors are considered in the analysis. However, this can be viewed, in part, as recognizing that the venture may in one way or another (through taxes, etc) be expected to eventually bear these costs.

8 For thorough technical treatment of investment criteria and related topics see Hirshleifer, J., Investment, Interest and Capital, Prentice-Hall, Inc., 1970, and Bierman, H. and Smidt, S., The Capital Budgeting Decision: Economic Analysis of Investment Projects, 5th ed., MacMillan Publishing Co., 1980.

9 Alfred Marshall, quoted in Bannock G. et al, The Penguin Dictionary of Economics, 2nd Edition, Penguin Books, 1982.

10 Lipsey, R. et al, Economics, Fourth Edition, Harper & Row, 1982.

11 Source: Table H4 in Bank of Canada Review, published monthly by the Bank of Canada, Ottawa.

12 These recommendations are attached to a memorandum from Hon. W. Parasiuk, Chairperson, E.R.I.C. and Hon. V. Schroeder, Chairperson of Treasury Board to All Cabinet Ministers regarding Common Format for Socio-Economic Project Analysis, Province of Manitoba, November 1, 1983.

13 Manitoba Bureau of Statistics, Manitoba Economic Multipliers, January, 1985.

14 To ensure that these values are updated annually on a consistent basis; the Economics and Program Review Section of Department of Natural Resources will prepare an annual report which a) documents the derivation of the values and b) presents the latest revisions.

15 Calculations were also performed using alternative discount rates of 3, 7 and 10 per cent. These are available from background documents pertaining to this Report.

APPENDICES

Appendix A Detailed Farm Production Costs

DETAILED FARM PRODUCTION COSTS

Table A1 to A5 provide various farm production costs for the crops in the study. All costs are standard for an agroclimatic Region 1 in which most of the Washow-Fisher agricultural lands would be located. No remoteness factors were included as they were deemed insignificant in the Washow-Fisher study area.

Annual Crops

The costs of production for annual crops are summarized in Table A1. Cropping costs were assumed to be identical across all soil types on which these crops would be grown.

Operating cost components for the annual crops of wheat, barley and canola(rapeseed) were obtained from the 1984 Crop Planning Guide prepared by the Farm Management Section, Maritoba Agriculture.

Note the following in Table A1:

1. 1984 ccsts are considered to be free of any abnormal market factors that would bias components higher or lower than what might be considered to be a good average cost. Any inflationary effects are assumed to be insignificant in all components.

2. Costs of crop insurance are excluded as crop insurance is not considered to be a pure cost of production. In the long run, premium costs will be balanced by damage payouts to the farmer.

3. The interest rate to calculate "interest on operating" was the same as that employed for the discount rate, to remove inflationary distortions.

Fixed cost components were also obtained from the 1984 Crop Planning Guide. However, these costs were recalculated to better reflect the true economic cost tc the farmer. All calculations requiring interest rates would use the same rate as that selected for the discount rate. The following is an example of the recalculations, using an interest rate of 5 per cent:

1. MACHINERY

The machinery depreciation and investment costs were recalculated as follows:

total capital investment	= $348/hectare
machinery life	= 8 years
salvage value	= 20%.

The portion which must be refinanced every eight years is $278.40 per hectare, ie. 348 - .2(348) = 348 - 69.60 = $278.40. The annual financing costs for interest and principal repayment, at 5 per cent, are $43.07. Note that this accounts fully for depreciation.

The salvage value portion of $69.60 has an opportunity cost for interest only as these funds could be invested elsewhere. This annual cost is estimated by multiplying the salvage value by the interest rate, $69.60 x 0.05 = $3.48.

The total annual fixed cost for machinery is, therefore, $43.07 + $3.48 = $46.55 per hectare.

2. GRAIN STORAGE

total capital investment	= $49.42/hectare
storage life	= 20 years
salvage value	= 10%.

The portion which must be refinanced every twenty years is $49.42 - .05(49.42) = $44.48 per hectare. The annual financing cost for interest and principal at 5 per cent is $3.57. The salvage value portion of $4.94 has an economic opportunity cost of $4.94 x 0.05 = $0.25 per hectare.

The total annual fixed cost for grain storage is, therefore, $3.57 + $0.25 = $3.82 per hectare.

3. LABOUR

Annual labour and management costs are assumed to be $39.50 per hectare, as

per the 1984 Crop Planning Guide. No distinction is made as to whether labour is provided by the farmer personally or hired. The farmer's own labour can be considered to be an opportunity cost, an estimate of what the farmer could earn at an alternative employment.

4. LOCAL TAXES

These were assumed to be $7.41 per hectare. This approximates the annual cost for the maintenance and operating costs of providing essential municipal services.

TAME HAY

As with annual crops, tame hay has both operating and fixed costs. The costing of tame hay is more complicated due to the necessity for an establishment year. Costs were based upon values provided in Guidelines for Estimating Alfalfa Hay Production Costs, June, 1984, as prepared by Manitoba Agriculture.

Operating costs are shown in Table A2 and fixed costs are shown in Table A3.

Tame hay costs can be summarized as shown in Table A4, including additional calculations to determine the average yearly cost of a hay rotation.

NATIVE HAY

In the production of hay from native forages only harvest costs need to be estimated (see Table A5).

Table A1 Total Annual Crops Production Costs

Meadow-Fisher Peninsula Study
(5% Real Interest Rate)
$ per Hectare

	WHEAT	BARLEY	Canola (RAPESEED)
Operating			
Seed Treatment	$ 20.90	$ 14.80	$ 20.25
Fertilizer			
N	41.50	41.50	47.45
P_2O_5	22.85	22.85	13.85
Chemicals	45.70	40.70	44.45
Fuel	22.25	22.25	22.25
Machinery Operating	17.30	17.30	17.30
Miscellaneous	12.35	12.35	12.35
SUBTOTAL	182.85	171.75	177.90
Interest on Operating (5%, 6 months)	4.57	4.29	4.45
TOTAL OPERATING COSTS	$187.42	$176.04	$182.35
Fixed			
Machinery	46.55	46.55	46.55
Grain Storage	3.82	3.82	3.82
Labour	39.50	39.50	39.50
Local Taxes	7.41	7.41	7.41
TOTAL FIXED COSTS	97.28	97.28	97.28
Total Production Costs	**$284.70**	**$273.33**	**$279.63**

Table A2 Annual Tame Hay Operating Costs

Meadow-Fisher Peninsula Study
(5% Real Interest Rate)
$ per Hectare

	LAND CAPABILITY CLASS	
	2, 3, 03, 6A(3A), 4	04, 5, 05
Establishment Year		
Seed	23.10 (alfalfa)	11.55 (grass)
Fertilizer	44.64	14.88 (33 1/3%)
Chemicals	21.75	-
Fuel	27.00	32.40 (+20%)
Machinery Operating	22.00	22.00
Miscellaneous	12.50	12.50
SUBTOTAL	150.99	93.33
Interesting on Operating (5%, 6 months)	3.77	2.33
Total	**$154.76**	**$95.66**
Producing Year		
Fertilizer	32.24	10.75 (33 1/3%)
Fuel	17.00	10.20 (60%)
Machinery Operating	22.00	13.20 (60%)
Miscellaneous	12.50	10.00
SUBTOTAL	83.74	44.15
Interest on Operating (5%, 6 months)	2.09	1.10
Total	**$85.82**	**$45.25**

Table A3 Annual Tame Hay Fixed Costs

Washow-Fisher Peninsula Study
(5% Real Interest Rate)
$ per Hectare

	LAND CAPABILITY CLASS	
	2, 3, 03, 6W(3W), 4	04, 5, 05
Establishment Year		
Machinery	46.55	46.55
Labour	39.50	39.50
Taxes	7.41	7.41
Total	**$93.47**	**$93.47**
Producing Year		
Machinery	33.25 (capital investment at 5/7 annual crops)	29.93 (90%)
Labour	39.50	27.65 (70%)
Taxes	7.41	7.41
Total	**$80.17**	**$64.99**

Table A4 Total Annual Tame Hay Costs

Washow-Fisher Peninsula Study
(5% Real Interest Rate)
$ per Hectare

Land Class	Operating	Fixed	Total	Rotation Years	Rotation Costs	Annual Rotation Costs
2, 3, 03, 6W(3W), 4						
- establishment	154.76	93.47	248.23	1	248.23	35.46
- producing	85.83	80.17	166.00	6	996.00	142.29
			TOTALS	7	$1,244.23	$177.75
04, 5, 05						
- establishment	95.66	93.47	189.13	1	189.13	27.02
- producing	45.25	64.99	110.24	6	661.44	94.49
			TOTALS	7	$850.57	$121.51

Table A5 Annual Native Hay Harvesting Costs

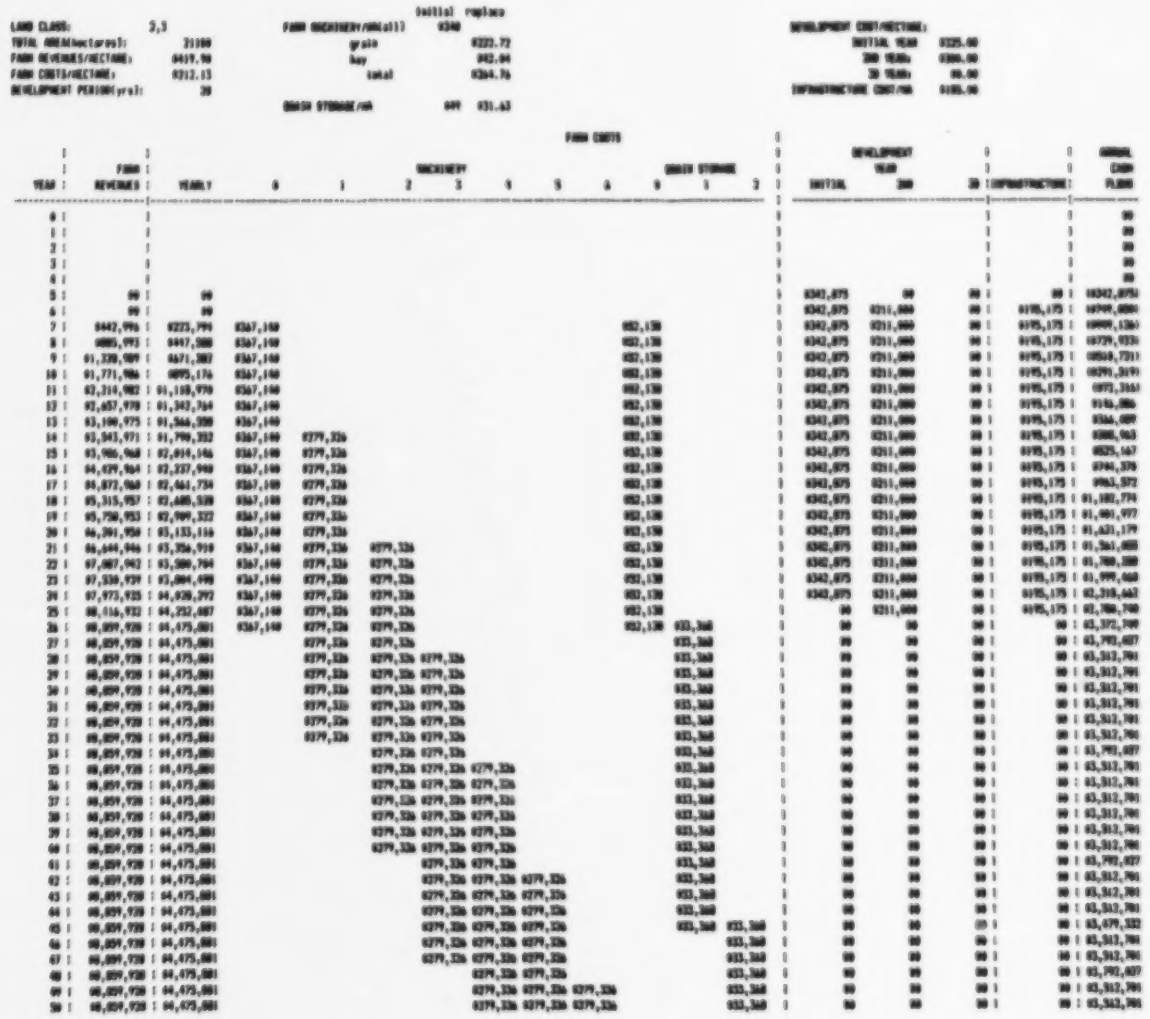
Washow-Fisher Peninsula Study
(5% Real Interest Rate)
$ per Hectare

Operating	
Fuel	13.60 (80% of tame hay producing year)
Machinery	17.60 (80% of tame hay producing year)
Miscellaneous	10.00
SUBTOTAL	41.20
Interest on Operating (5%, 6 months)	1.03
Total	**$42.23**
Fixed	
Machinery	33.25 (same as tame hay producing year)
Labour	39.50
Taxes	2.47
Total	**$75.22**

Total of Operating and Fixed = 42.23 + 75.22 = $117.45/hectare.

Appendix B Agricultural Cash Flow Projections Class 2,3

- Commercial Feasibility Aspect - 5 % Discount Rate



Appendix C Metric Conversions

Forestry

1 cubic metre	= 0.4 cords (approximate) OR 35.3147 ft^3 OR 176.6 fbm (roundwood)

Agriculture

1 tonne wheat	= 36.744 bushels
1 tonne barley	= 45.930 bushels
1 tonne canola (rapeseed)	= 44.092 bushels

General

1 hectare	= 2.4710 acres
1 tonne	= 1.1023 tons